Operational Evolution Plan

En Route Hazardous Weather

EW-1
Integrate Weather Information into Traffic Flow Management

The disruptions in air traffic caused by hazardous en route weather are magnified by the lack of common understanding of weather information, and the intrinsic uncertainty of the forecast. There is a discrepancy between weather forecasts and the observed weather; there is a deficiency in the application of weather information to manage traffic flow in congested airspace. A commitment to operational change can be implemented by first improving the detection and forecasting of hazardous weather, although these improvements will be incremental. Secondly, the impacts of weather can be mitigated through improved distribution, display, training, and application of weather information. Finally, the integration of weather information into Decision Support Systems (DSSs) and automated tools will achieve the full potential for operational change by maximizing the capacity of the airspace and improving the efficiency with which the NAS is utilized, even during disruptive events of hazardous weather.

Key Activities:

Complete an Integrated Project Plan	7/03
Complete EW-1 plan and milestones	9/03
ATM/DSS Workshops	1/03; FY04
CDM Workgroup Report on Weather Applications	1/03; 9/03
Training Plan for Convective Products	5/03
Weather products on ETMS	2X per year

Weather and Traffic Database, Phase 1	9/03
CCFP Requirements	3/03
CIWS Evaluation	9/03
AWTT Assessment of Weather Products	Annually

Smart Sheet:
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EW-1: Integrate Weather Information into Traffic Flow Management

Improvements in the detection and forecasting of hazardous weather that adversely affects flight operations in the en-route domain are the first steps. But a change in operational practice requires an integration of weather information into decsion support systems and automated tools, as well as improvements in the communications and display of weather information, and the development of applications and training. ("Weather information" includes detection and forecast of hazardous weather as well as collecting current observations.)

Background

Forecasts of hazardous weather have always been considered essential to maintain aviation safety. In addition, however, the existence of hazardous weather in a congested airspace can cause a severe reduction in capacity and efficiency of the NAS. In an effort to mitigate these reductions in capacity and maximize to use of the available airspace, a variety of tactics are used to evade hazardous weather, but these are difficult to evaluate because of 2 limitations:

1. A discrepancy between weather observations and the forecast skill (accuracy; precision, intensity, and reliability);
2. A deficiency in using weather information in Traffic Management strategies that mitigate the effects of hazardous weather in the en route environment.

Weather hazards are difficult to predict precisely and reliably because they depend on small scale processes that are not directly measured. Furthermore, hazards of icing and turbulence are often very localized and not uniformly distributed. In addition, the desired lead-time for prediction of thunderstorms covers several life-cycles of unstable overturning circulation imbedded in the atmosphere that sometimes includes a strong interaction with the surrounding flowstream.

The loss of capacity is even more difficult to manage because the required precision and lead time needed by strategic planning and national traffic flow decisions cannot be attained by weather forecasting. The uncertainty in the timing (as well as the location) of hazardous weather forecasts makes it difficult to identify the correct operational response in an air traffic environment where time is the most critical parameter. It is also difficult to create a smooth and efficient transition from strategic planning to a tactical response.

Plans for integrating weather information into TFM are based on the accomplishments of the past 3 years in which there has been a substantial investment in weather research and development. Many products and systems have been transferred into an operational environment:

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- ADDS Aviation Digital Data Service on the Internet
- RTVS Real Time Verification System to verify convective forecasts
- CCFP Collaborative Convective Forecast Product to forecast thunderstorms 2/4/6 hours in advance
- NCWF National Convective Weather Forecast to identify and forecast thunderstorms on a national scale 1 hour in advance.
- ITWS Integrated Terminal Weather System to observe and forecast out to 1 hour in advance local thunderstorms using Doppler radar data.
- CIP Current Icing Potential identifies areas and altitudes of hazardous icing conditions.
- RUC Rapid Update Cycle weather forecast model now resolves winds and convection down to 20 km in the horizontal.
- Weather and Radar Processor displays NEXRAD data on the DSR controller screen based on a successful implementation at DFW.

The solution set for the EW Quadrant has also changed from “better data” to a single element that integrates priority weather objectives into a program leading to operational change: “Integrate Weather Informaiton into Traffic Flow Management”. The foundation for these revisions are several important benchmark studies and the recommendations of advisory groups:

- An Aviation Weather Mission Need Statement (MNS) has been completed by ARQ-1 and approved by the Joint Science Counsel (JSC; 2002). Included in the MNS are 16 topics, of which the first priority is Thunderstorms; the second priority is Icing; next is Turbulence and Flight Level Winds.
- A Workshop of the National Research Council (NRC; June 2002) has addressed Weather Forecasting Accuracy for Traffic Flow Management. Although the assessment of the Workshop by a select committee of the NRC is not yet complete, there was encouragement to sustain the development and application of objective weather forecast models.
- The Second Workshop on Air Traffic Management and Decision Support Systems (July 2002) was sponsored by AUA-1 and MITRE, NCAR, and MIT/Lincoln Labs. The participants stressed the ultimate objective which is to integrate weather forecasts into automated traffic management tools in Decision Support Systems.
- The Aviation Weather Technology Transfer (AWTT) Board has developed a disciplined process for transferring research results into operational practice. The Board has developed standards for operational products and is leading the effort to encourage the early development of a Concept of Operations for each weather product.
- The Workgroups of Collaborative Decision Making (CDM) include participants from airlines, government and employee unions. The Workgroups are leading the implementation of changes to the traffic management system. Workgroups on weather, training, and integrated TFM are especially relevant.

Ops Change Description

The first strategy for achieving the goal of EW-1 is blindingly simple: increase the skill of all forecasts of hazardous weather. Such a strategy would eliminate the weather discrepancy, and would provide a traffic flow management specialist increased confidence in their decisions to mitigate congestion. Unfortunately, forecast skill beyond a few hours is low, and the best technical evidence from the science community (NAS, 2002) is that improvement in forecast skill will be incremental. However, this approach is a direct attack on the problem and it must be sustained.

First strategy: Increase the skill (accuracy, resolution, intensity, and reliability).

In order to make operational changes, however, weather information must not only be "better", it must also be used more effectively. The existing, uncertain operational weather forecasts can be used for air traffic decisions that will mitigate, but not eliminate adverse impacts on the NAS. This requires a description of the strengths and weaknesses of new weather products, and training on the use of weather information for traffic management. Included in this strategy is an integration of a spectrum of weather products to avoid overlap and confusion. Improving the training will require the development of "best practices" that are a result of operational experience, and a systematic, two-way feedback from the experience of mistakes and triumphs between users of weather forecasts and providers of weather information.

Second Strategy: Mitigate impacts of weather on traffic in the NAS.

Finally, in order to achieve the full benefits of operational change, reactions to redirecting flights must be understood before the decision is made. Note that although hazardous weather restricts airspace, the decisions of Traffic Management Specialists and Traffic Controllers may often concentrate traffic flows in other regions of the airspace which subsequently requires delay programs, flight restrictions, or ground stops. This circumstance is exacerbated by the uncertainty in the weather forecast and the sheer number of aircraft that need direction. In this environment, "better" weather information is insufficient by itself; it must be used in conjunction with traffic management tools to manage the consequences of traffic decisions that were first initiated in reaction to hazardous weather threats. This can best be done through the development of Decision Support System (DSSs) and automation tools that bring objective weather information into the decision. Thus, the ultimate payoff is contained in the third strategy.

Third Strategy: Manage the reaction to traffic flow decisions

Both improvements to the forecast of weather hazards, and improvements in the application of forecasts to traffic flow management are based on the priorities of the Mission Need Statement for Aviation Weather (ARU-1, 2002). The results from these priority engineering projects capitalize on state-of-the art empirical scientific investigations and research. For thunderstorms, the focus is forecasting of growth, decay, movement, intensity, and coverage. For icing and turbulence, the focus is the forecasting of intensity and coverage, especially in the vertical dimension, and its evolution in time.

However, since improvements in forecasts of hazardous weather can be expected to continue only incrementally; improved forecasting alone will not produce completely the desired results. How these improved products are disseminated, displayed, interpreted and applied (EW-1.2, 1.3) is just as important as improving the forecast itself (EW-1.4). Feedback to the producers of forecasts depends on a resident database of coincident weather and traffic data, and the ability to access these data and perform critical assessments in near-real-time. Operational change can be initiated with practical guidelines from experience that can be used to impact strategic planning and tactical decision making, based on reliable, shared situational awareness.

But the full potential of operational change cannot be achieved without Decision Support Systems (DSSs) and automated procedures that will accept and integrate weather and traffic information (EW-1.1) The DSSs are used to guide decisions that mitigate the impacts of hazardous weather, as well as to evaluate the consequences of possible traffic management options. This is the ultimate goal of the EW Quadrant, and the Solution Set (EW-1). The objective is shared with ER-2 (Collaborate to Manage Congestion), and it was part of the former EW-2 (that was moved to ER-2).

The EW-1 Solution Set consists of the following structure:

EW-1.1 Integrate Weather Forecasts into Decision Support Systems (DSSs)
1.1.1 Route Availability Planning Tool (RAPT)
1.1.2 Enhanced Traffic Management Service (ETMS)

EW-1.2 Commit to applications and training
1.2.1 Applying the Weather Forecast
1.2.2 Training for Users

EW-1.3: Ensure dissemination and display of weather information
1.3.1 WARP PPI
1.3.2 Weather display on ETMS
1.3.3 Weather communication architecture
1.3.4 Weather Database
1.3.5 Post Analysis and Feedback

EW-1.4: Improve the detection and forecast of hazardous weather
1.4.1 Thunderstorms (Thunderstorm Impact Mitigation)
1.4.2 Turbulence (Non-Convective Turbulence and Winds Aloft Optimization)
1.4.3 Icing (In-Flight Icing)
1.4.4 Weather Forecast Models

Most of the elements of this Solution Set are already in existence. However, the objectives are independent and milestones have not been integrated into the EW-1. To take the next step and make the Solution Set productive, several Key Decisions must be made (below). The foremost decision is to identify a weather Focal Point who can mobilize the existing projects into an coherent program to meet the objectives of this Solution Set, EW-1. Subsequently, existing projects will be fully identified in an Integrated Project Plan that will be summarized in fully developed EW-1 Solution Set that will match the Key Activities of the EW Sector

Benefit, Performance and Metrics

- Reduction in the variance of flight time as compared to the schedule.
- Reduction in number and/or duration of ground delay programs in support of SWAP for en-route hazardous weather constraints.
- Reduction in the number and/or duration of ground stops due to hazardous en-route weather constraints.
- Reduction in fuel diversions due to hazardous weather encountered.
- Increase the equity of the NAS. This equity is achieved from narrowing the confidence gap that exists today from one system user to another or one FAA facility to another. Metrics are system access; area throughput; increased user acceptance of the daily Strategic Plan of Operations and

equitable distribution of system resources.

Key Decisions for the En Route Weather Program

- Identify a Weather Focal Point and affirm the concept that will initiate and sponsor strategies to achieve operational change.
  - Coordinate and mobilize FAA weather offices to address the EW-1 structure and plan for operational change
  - Agree on projects, and designate project Leads
  - Write a integrated project development plan
- Transfer results from operations research into Decision Support Tools
  - Apply results from Lincoln Labs, MITRE, and NCAR, as presented in annual ATM and DSS Workshop (Jan 2003, and ongoing)
  - Development of a Concept of Use for weather in TFM
  - Apply results from the CDM-CR Workgroup on Weather Applications (WeaApls),(July 2003, and ongoing)
- Commit to institutional training and development of training materials for both passive (CBI) and active training of AT Controllers and TM Specialists.
  - Results from the CDM-CR Workgroup on Training (2003, and ongoing)
- Sustain funding for research and development of projects:
  - the Aviation Weather Research Program (AWRP). Project Review Teams (2002, and ongoing)
  - Development of a Aviation Weather Database of convective weather records with concurrent weather information and Air Traffic data archive (2003)
- Obtain support from constituents (NATCA, NWSEO, NAATS, ADF, ALPA, APA, ATA NBAA, RAA, SAMA) for affirming the objectives of Integration of Weather Information for Traffic Flow Management.
  - Meeting of CDM-CR Workgroup on WeaApls (Dec 2003, and ongoing)
  - Meeting of ATA Met Committee (April, October 2003)
  - Meeting of Friends/Partners of Aviation Weather (Oct 2003)

Key Risks

- Coherence of an OEP program for Enroute Weather that brings diverse elements together for a common objective.
- Agreement on project-management roles for taking initiative, including responsibilities, coordination, accountability, and tracking progress.
- Agreement among all the extramural constituents and stake holders that are concerned with the use of weather information for managing en route traffic.
- Cooperation from the National Weather Service and the funding of improvements to contracted operational support.

Decision Tree

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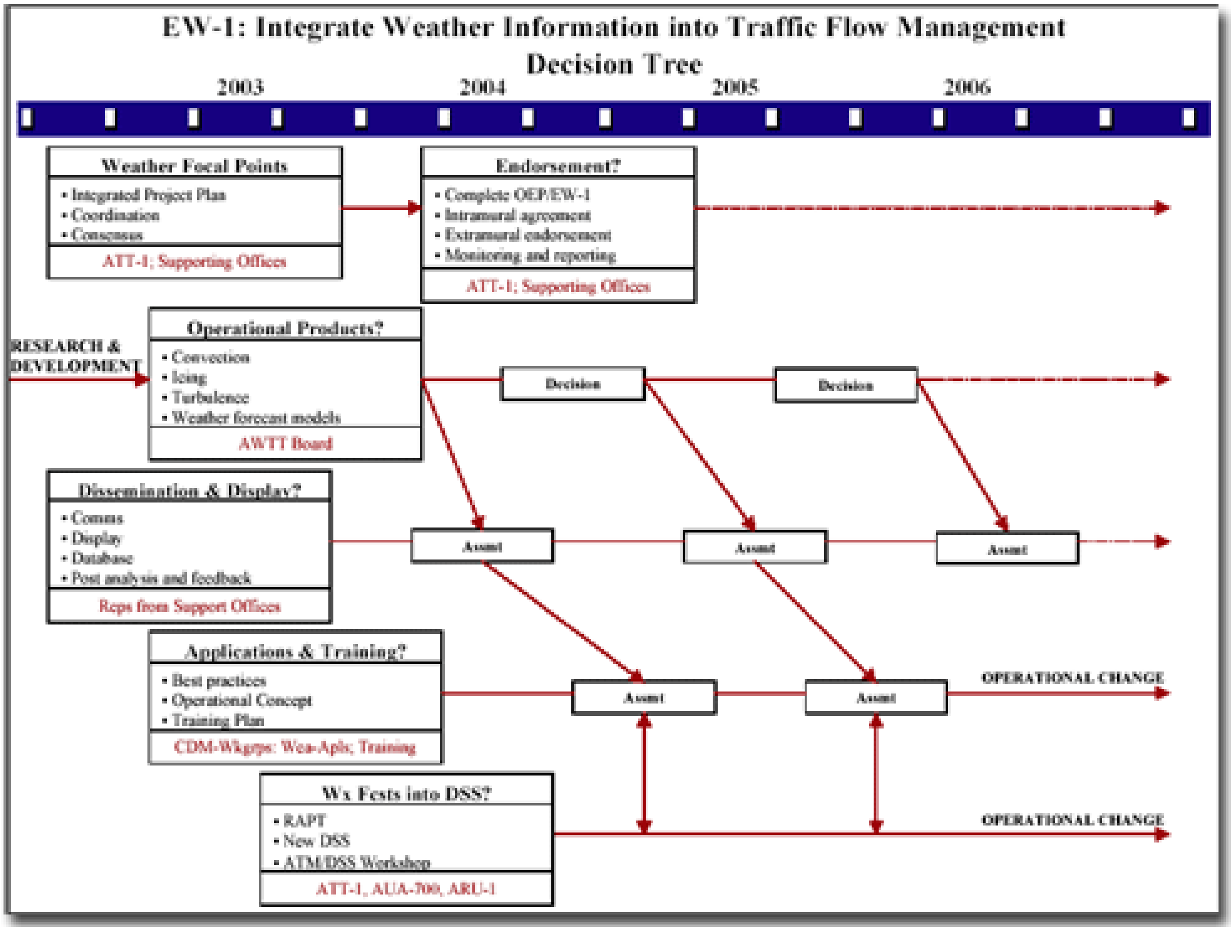

[View enlarged decision tree]

Responsible Team

Primary Office of Delivery
Jack Kies, ATT-1

Support Offices
ATP-1
AUA-1
AUA-200
AOZ-1
AUA-400
AUA-700
ARU-1
ARS-1
ATA-1
AOZ-1
ASD-1

Other Websites
Relationship to the Architecture